



299-W19-45 (C3394)

Log Data Report

Borehole Information:

Borehole: 299-W19-45 (C3394)			Site: U Farm Perimeter		
Coordinates		GWL (ft) ¹: ~224.3	GWL Date: 8/15/01		
North	East	Drill Date	TOC ² Elevation	Total Depth (ft)	Type
N/A ³	N/A	8/01	N/A	266.1	air rotary

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel threaded drill pipe	0.25	8.25	7.25	.75	0	266.1

Borehole Notes:

This borehole is a RCRA groundwater well that was logged through the drill pipe.

Logging Equipment Information:

Logging System: Gamma 2B	Type: SGLS (35%)
Calibration Date: 9/00	Calibration Reference: GJO-2001-245-TAR
	Logging Procedure: MAC-HGLP 1.6.5

Logging System: Gamma 2E	Type: NMLS
Calibration Date: 5/01	Calibration Reference: GJO-2001-247-TAR
	Logging Procedure: MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2/Repeat	3	4/Repeat	
Date	8/15/01	8/15/01	8/16/01	8/16/01	
Logging Engineer	Musial	Musial	Musial	Musial	
Start Depth (ft)	0	115	114	135	
Finish Depth (ft)	115	103	266	150	
Count Time (sec)	200	200	200	200	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
ft/min	n/a ⁴	n/a	n/a	n/a	
Pre-Verification	B00036CAB	B00036CAB	B00037CAB	B00037CAB	
Start File	B0036000	B0036116	B0037000	B0037153	
Finish File	B0036115	B0036128	B0037152	B0037168	
Post-Verification	B00036CAA	B00036CAA	B00037CAA	B00037CAA	

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	1	2	3/Repeat		
Date	8/16/01	8/16/01	8/16/01		
Logging Engineer	Musial	Musial	Musial		
Start Depth (ft)	0	111.75	110		
Finish Depth (ft)	111.75	225	88		
Count Time (sec)	n/a	n/a	n/a		
Live/Real	n/a	n/a	n/a		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	0.25	0.25	0.25		
ft/min	1.0	1.0	1.0		
Pre-Verification	C0012CAB	C0012CAB	C0012CAB		
Start File	C0012000	C0012448	C0012901		
Finish File	C0012447	C0012900	C0012989		
Post-Verification	C0012CAA	C0012CAA	C0012CAA		

Logging Operation Notes:

A longer count time (200 sec) was required with the SGLS because of the relatively thick casing. The borehole was logged in the drill pipe before completion as a groundwater monitoring well. To obtain reliable spectra while minimizing overall logging time, the depth interval was increased from 0.5 to 1.0 ft.

SGLS log depths are relative to ground level. During logging runs, no fine gain adjustments occurred.

The pre-run verification B0036CAA file passed the verification criteria. The post-survey verification B0036CAA failed to meet the acceptance criteria. The counts of the 1460- and 2614- keV peaks were both below the warning limits, and the counts of the 609-keV peak were below the control limit. The tool, however, appears to be functioning normally. The counts of the 609- and 1460-keV peaks in the pre-survey verification B0037CAB were both below the warning limits, however, the tool appears to be functioning properly.

Neutron moisture logs were run on 8/16/01 using the RLS 1, and log depths are relative to ground level. The neutron moisture tool was run centralized.

Analysis Notes:

Analyst:	Sobczyk	Date:	08/28/01	Reference:	MAC-VZCP 1.7.9 Rev. 2
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Pre-run and post-run verification spectra for the SGLS were evaluated. All of the pre-survey verification spectra were within the control limits. The post-survey verification spectrum for logging run 1 (file B00036CAA) was the only post-survey verification spectrum that was outside of the control limits. The peak counts per second for the 609-keV peak was below the lower control limits for this post-run verification spectra. Examinations of spectra indicate that the detector appears to have functioned normally during the log run. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for a casing thickness of 3/4 in. from the ground surface to 266 ft. A correction for water in the borehole was applied below 224 ft. Dead time corrections were not necessary.

Moisture calibration models at Hanford for 10-in. holes with 3/4-in. casing have not been established. Thus, the neutron log was not processed to estimate volumetric moisture content because the relatively large borehole diameter and casing thickness are beyond the range of conditions for which the tool was calibrated. Neutron data are presented as gross counts. In general, an increase in neutron count is

indicative of an increase in moisture content, but a quantitative calculation of volumetric moisture cannot be made at this time.

Moisture calibration models at Hanford for 8-in. diameter casing with 0.322-in. thickness have been established. A casing thickness correction (relative to 8-in. casing) can be estimated. Thus, corrections were applied to the gross neutron cps to estimate volumetric moisture content with the established 8-in. hole-size correction and the 1/2-inch casing thickness for 8-in.-diameter casing. Neutron data are also presented as gross counts. In general, an increase in neutron count is indicative of an increase in moisture content.

The rerun of the neutron-moisture tool shows good repeatability, and the rerun may be off-depth by -0.25 ft compared to the original run.

Log Plot Notes:

Separate log plots are provided for gross gamma, naturally occurring radionuclides (^{40}K , ^{232}Th , ^{238}U , and associated decay progeny), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable activity (MDA) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and does not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. A neutron moisture log of neutron counts is also shown on the combination plot.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected. ^{137}Cs activity was detected at the three points near the ground surface. The measured ^{137}Cs activity ranged from 0.4 to 1.4 pCi/g and is interpreted as surface contamination. A marginal peak at 1408 keV was observed at 140 ft (file B0037026); this peak is interpreted as the ^{238}U (^{214}Bi) 1407.98-keV peak, not the ^{152}Eu 1408.01-keV peak, because it is in a caliche layer with a high ^{238}U content.

The changes in gross gamma counts depend primarily upon changes in ^{40}K activities. The increase in gross gamma counts from about 85 cps to about 130 cps at a log depth of 53 ft corresponds with an increase in apparent ^{40}K activity from about 13 to 19 pCi/g. This increase in total gamma is interpreted as the Hanford H2. The increase in ^{232}Th activity from about 0.8 to 1.2 pCi/g and the increase in gross gamma counts from 125 to 145 cps at 124 ft probably represent the top of the Early Palouse Soil. On the basis of low K-40 activities, the carbonate-rich paleosols of the Pliocene-Pleistocene are interpreted as being between 139 ft and 143 ft. The caliche layer with characteristically high uranium content (greater than 2.0 pCi/g) is present between 140 and 144 ft. The top of the Ringold is picked at 146 ft.

Below 224 ft, the apparent increase in ^{238}U activity based on the 609-keV spectral line of about 1 pCi/g is greater than the apparent increase in ^{238}U activity based on the 1764-keV line of about .25 pCi/g. This apparent increase in ^{238}U at groundwater is probably the result of dissolved radon (^{222}Rn) in the water. Quantification of naturally occurring ^{238}U is based on measurement of the daughter ^{214}Bi , assuming that secular equilibrium has been attained. However, ^{214}Bi is also a short-term daughter of ^{222}Rn . The presence of ^{222}Rn is indicated by elevated counts in spectral peaks associated with ^{214}Pb and ^{214}Bi and does not indicate an increase in ^{238}U . The fact that a discrepancy exists between the ^{214}Bi lines at 609 and 1764 keV suggests that radon and its daughters are present within the water. The apparent concentration based on the 609-keV peak appears to increase more than that based on the 1764-keV peak because the water correction factor decreases with increasing energy level. If the source of the gamma photons is within the water, then there is less attenuation than would be expected, and the effect of the water correction is an apparent increase in the calculated concentration.

The neutron moisture tool's depressed response in this hole is due to the low-activity source, and short source-to-detector spacing. The highest neutron counts occurred in the groundwater as expected. The

elevated neutron counts per second that occur at about 125 through 140 ft correspond with an interval of relatively high total gamma interpreted as the Early Palouse Soil.

¹ GWL – groundwater level

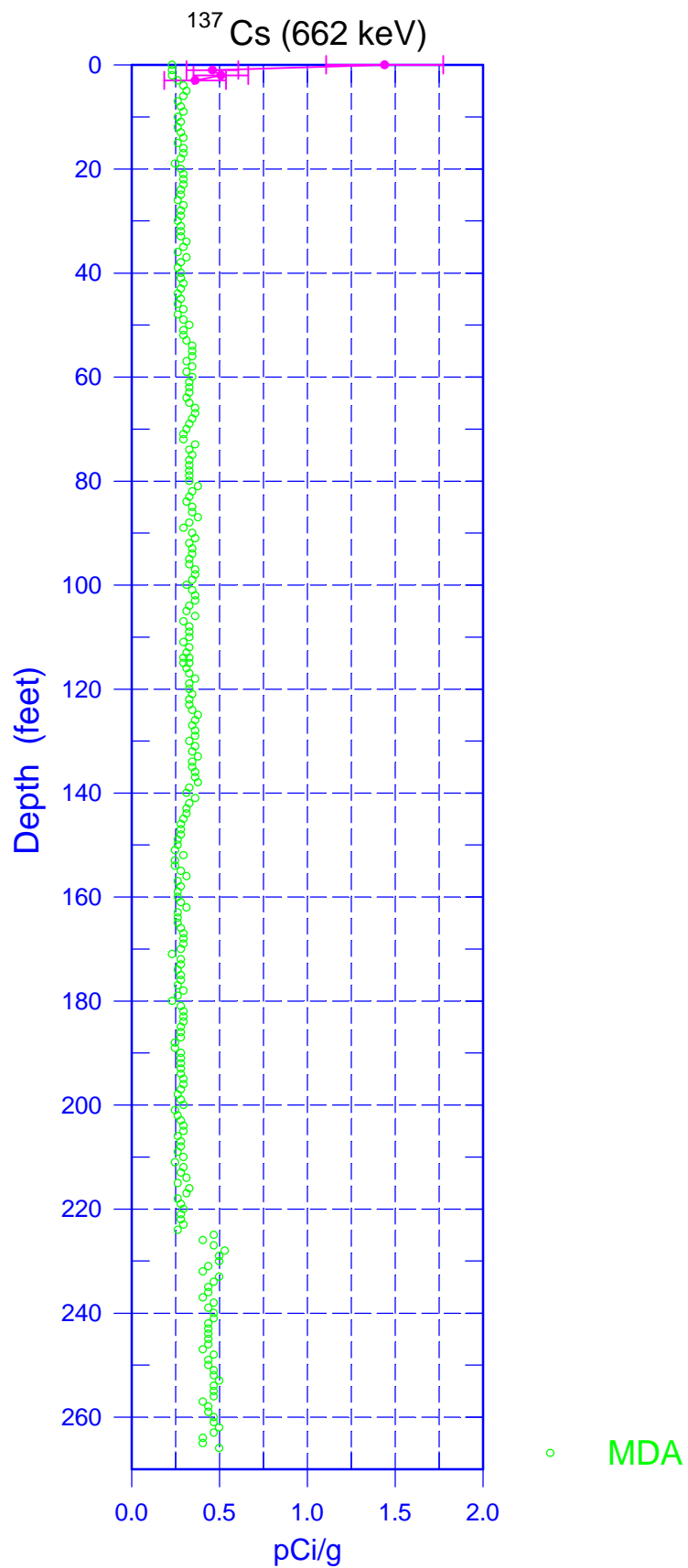
² TOC – top of casing

³ N/A – not available

⁴ n/a – not applicable

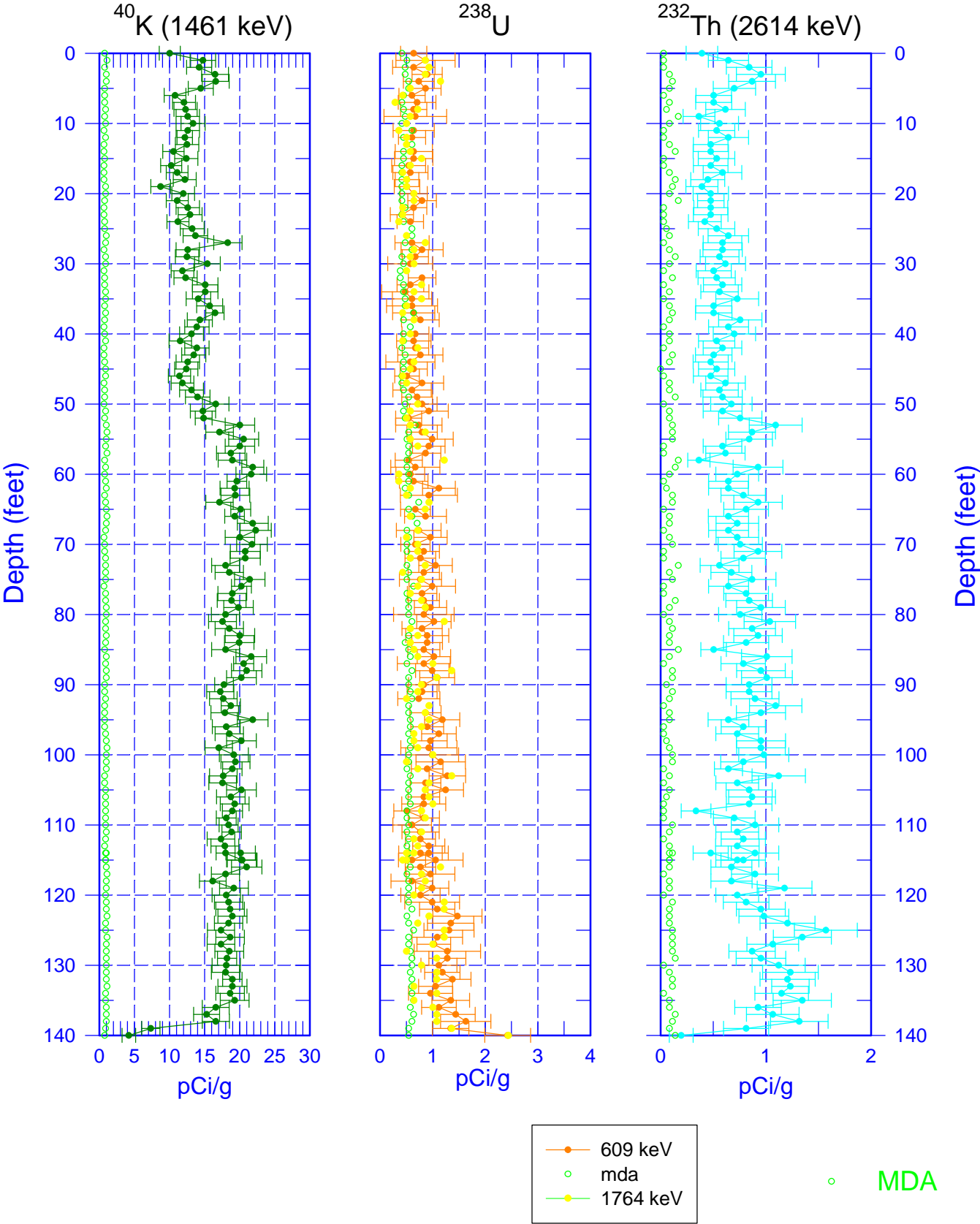
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Man-Made Radionuclide Concentrations



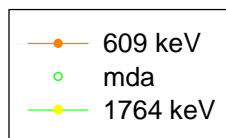
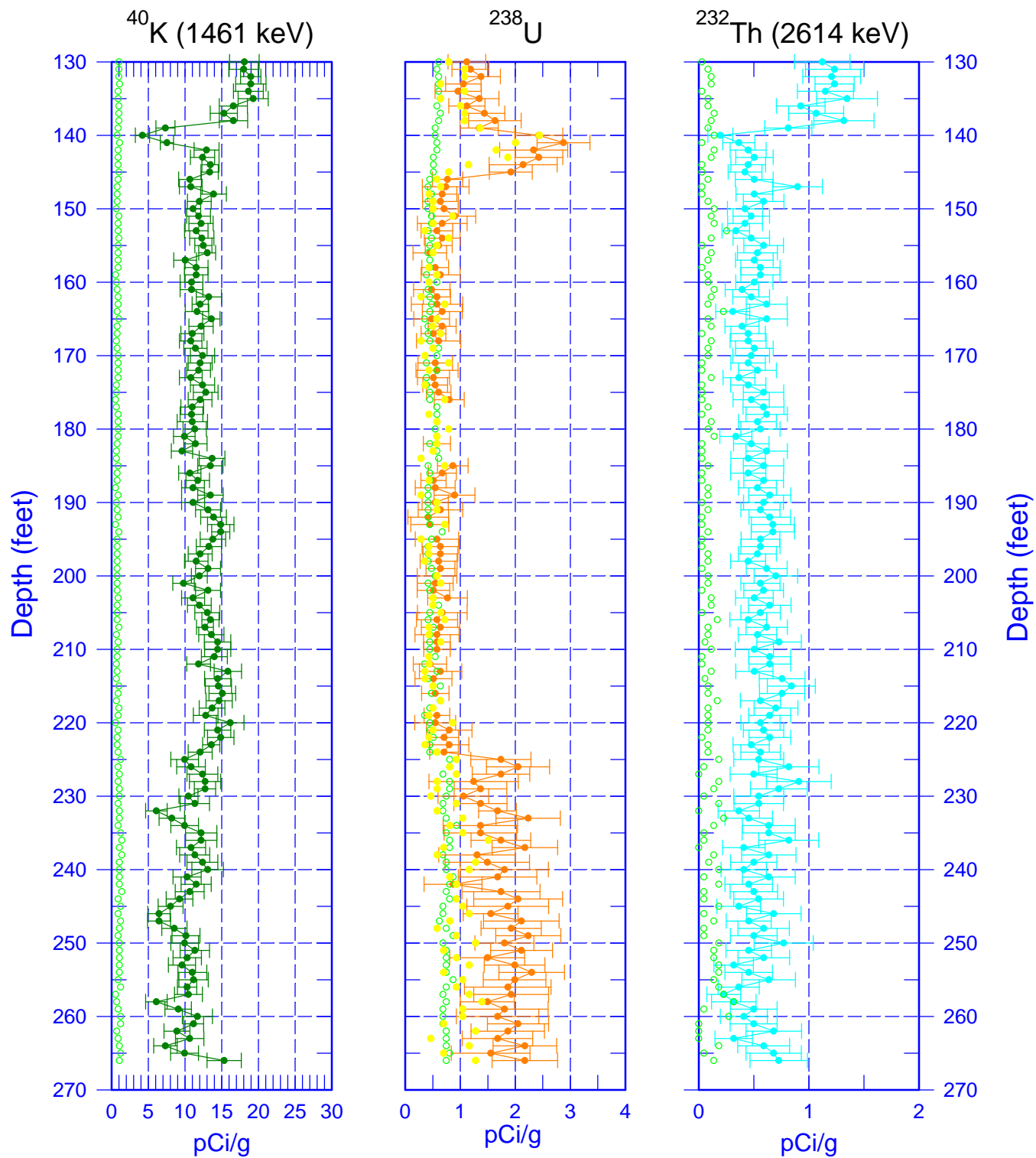
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Natural Gamma Logs



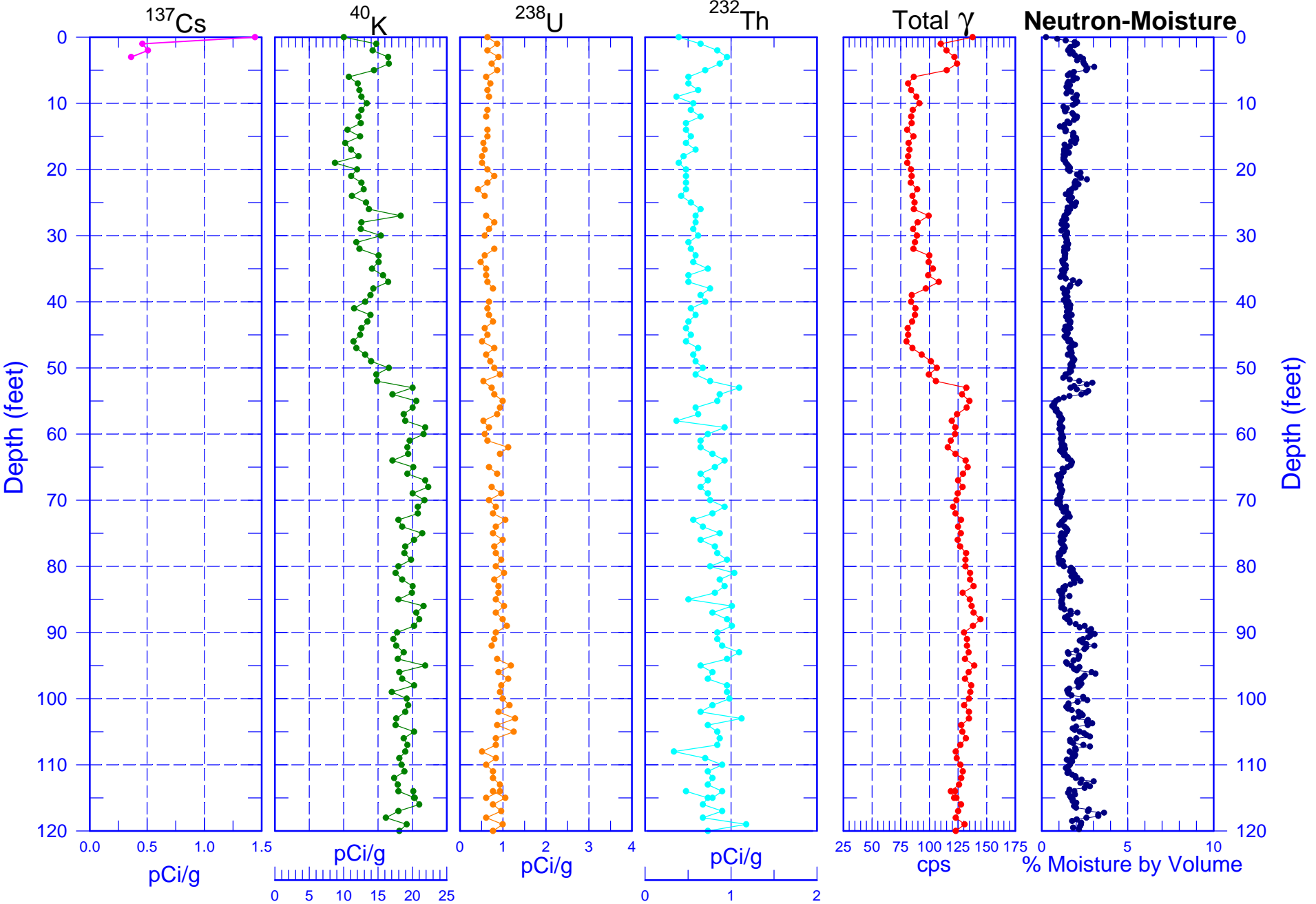
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Natural Gamma Logs

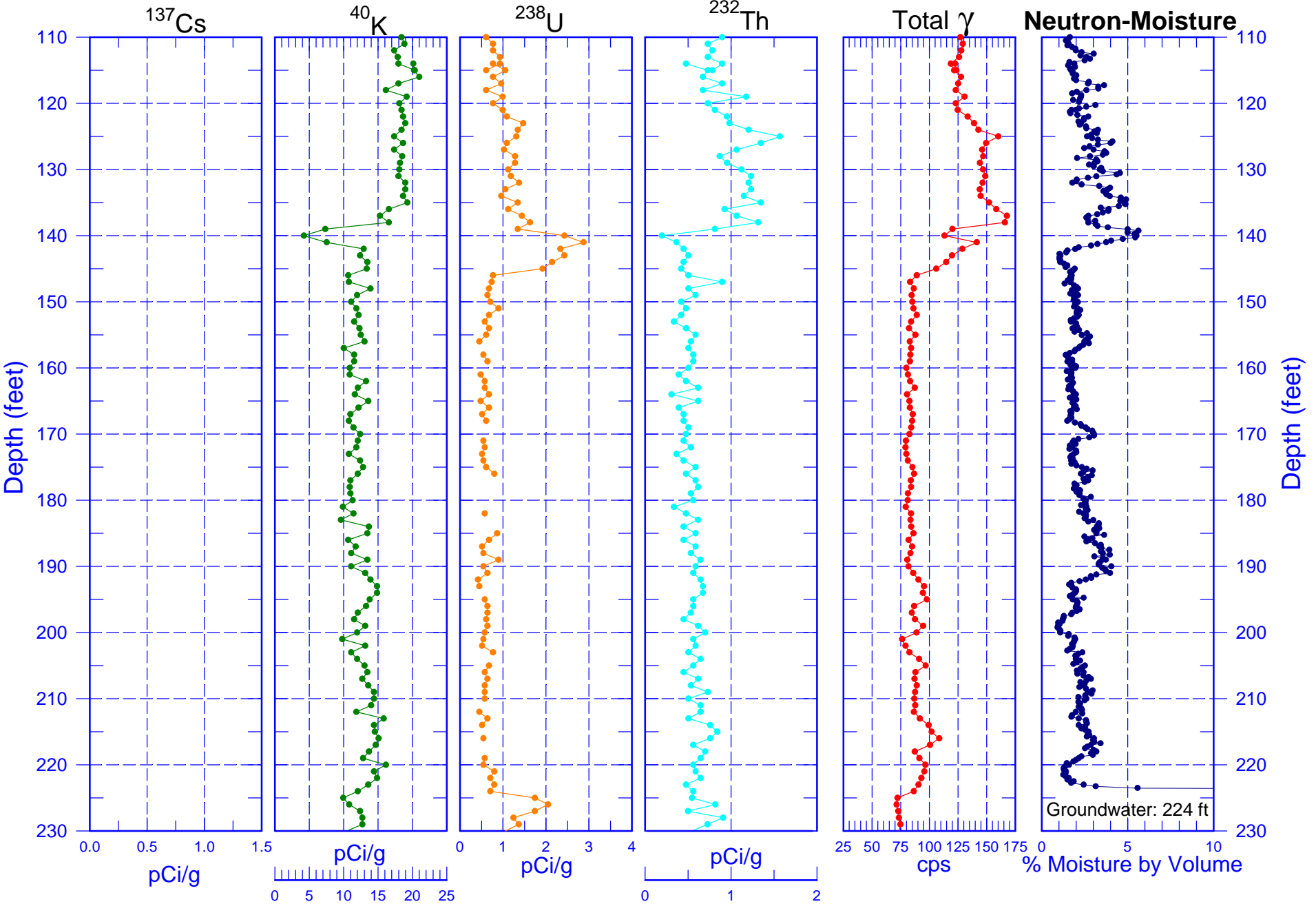


MDA

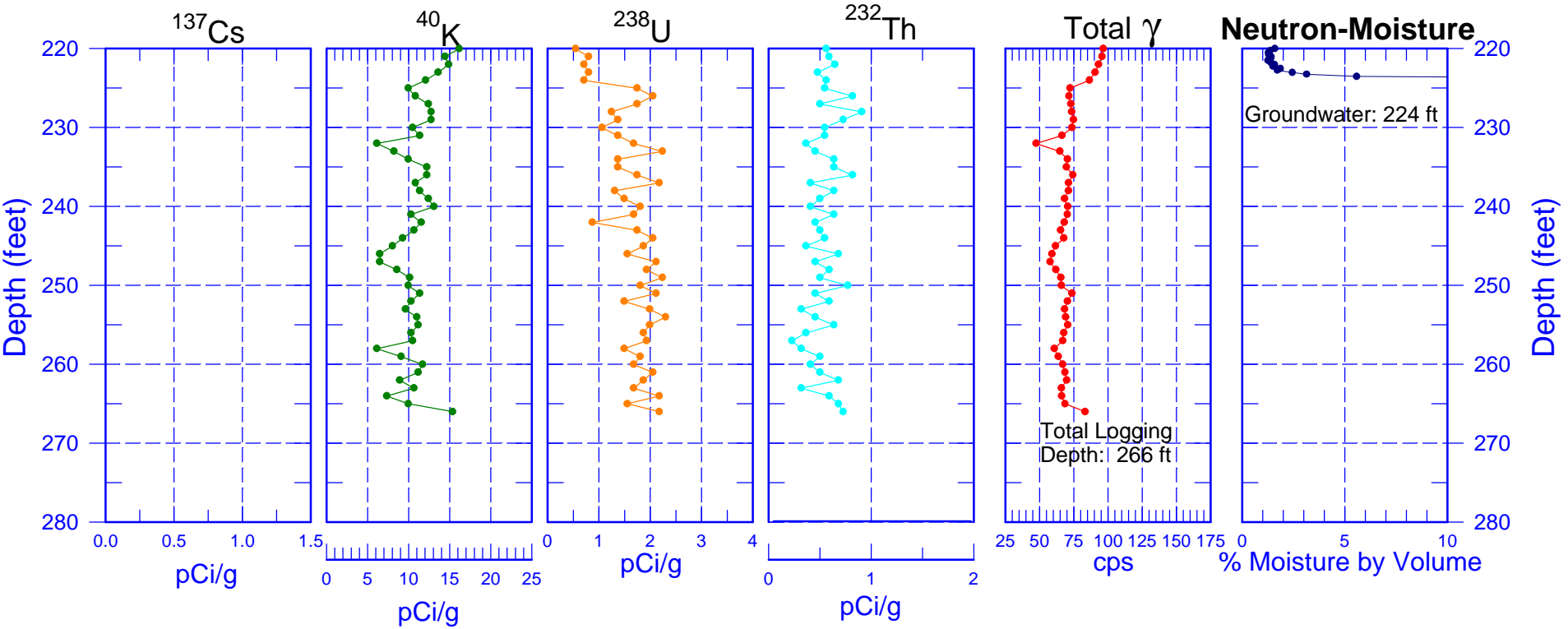
299-W19-45 (C3394) Combination Plot



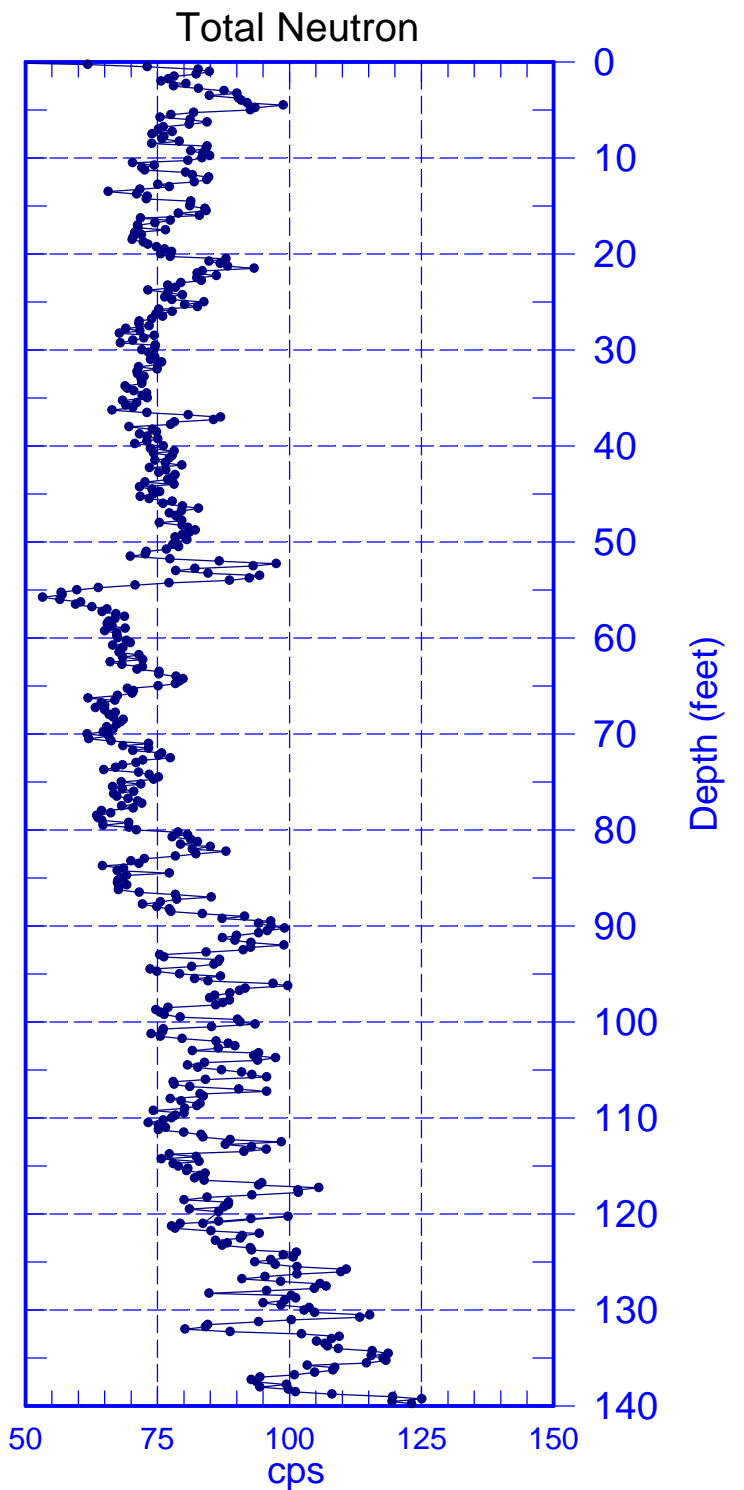
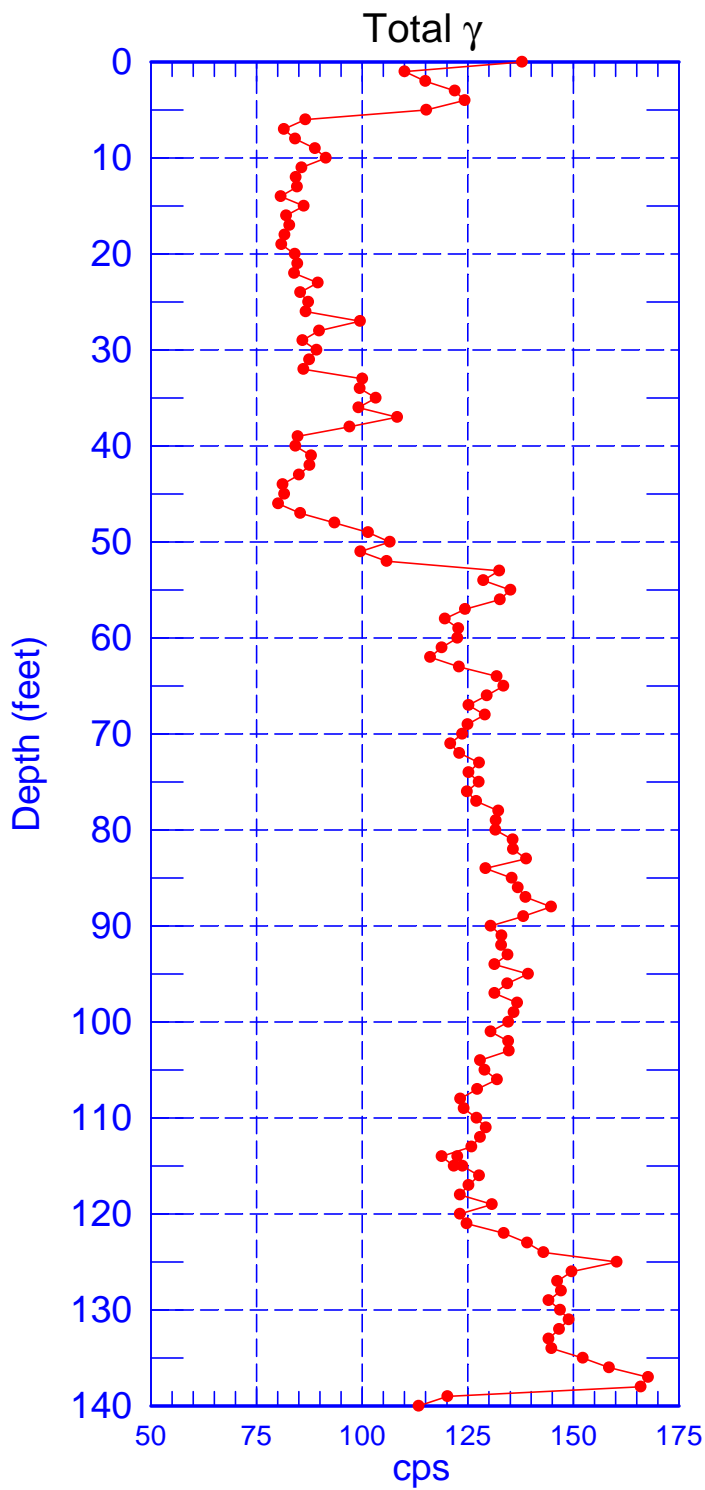
299-W19-45 (C3394) Combination Plot



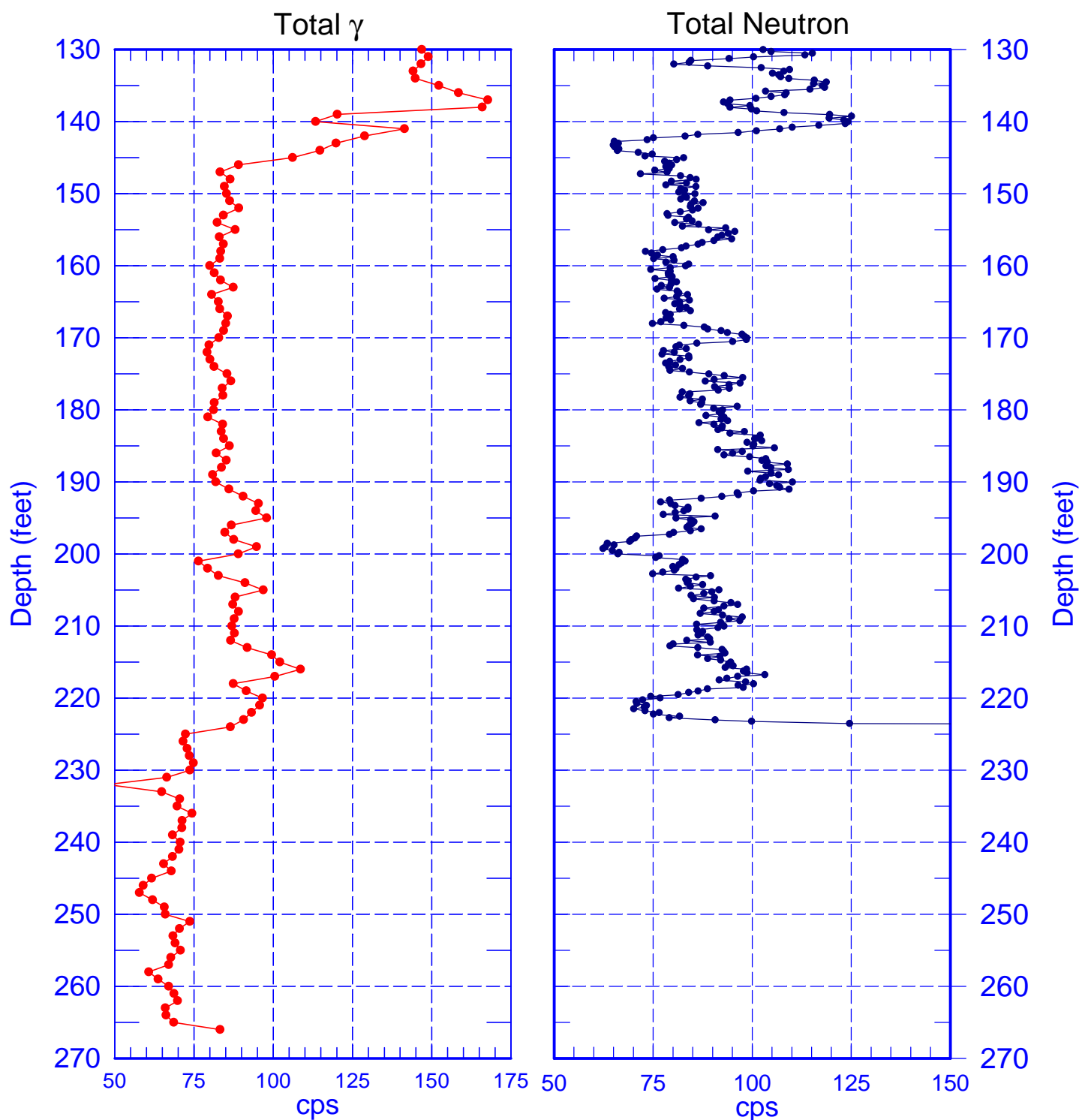
299-W19-45 (C3394) Combination Plot



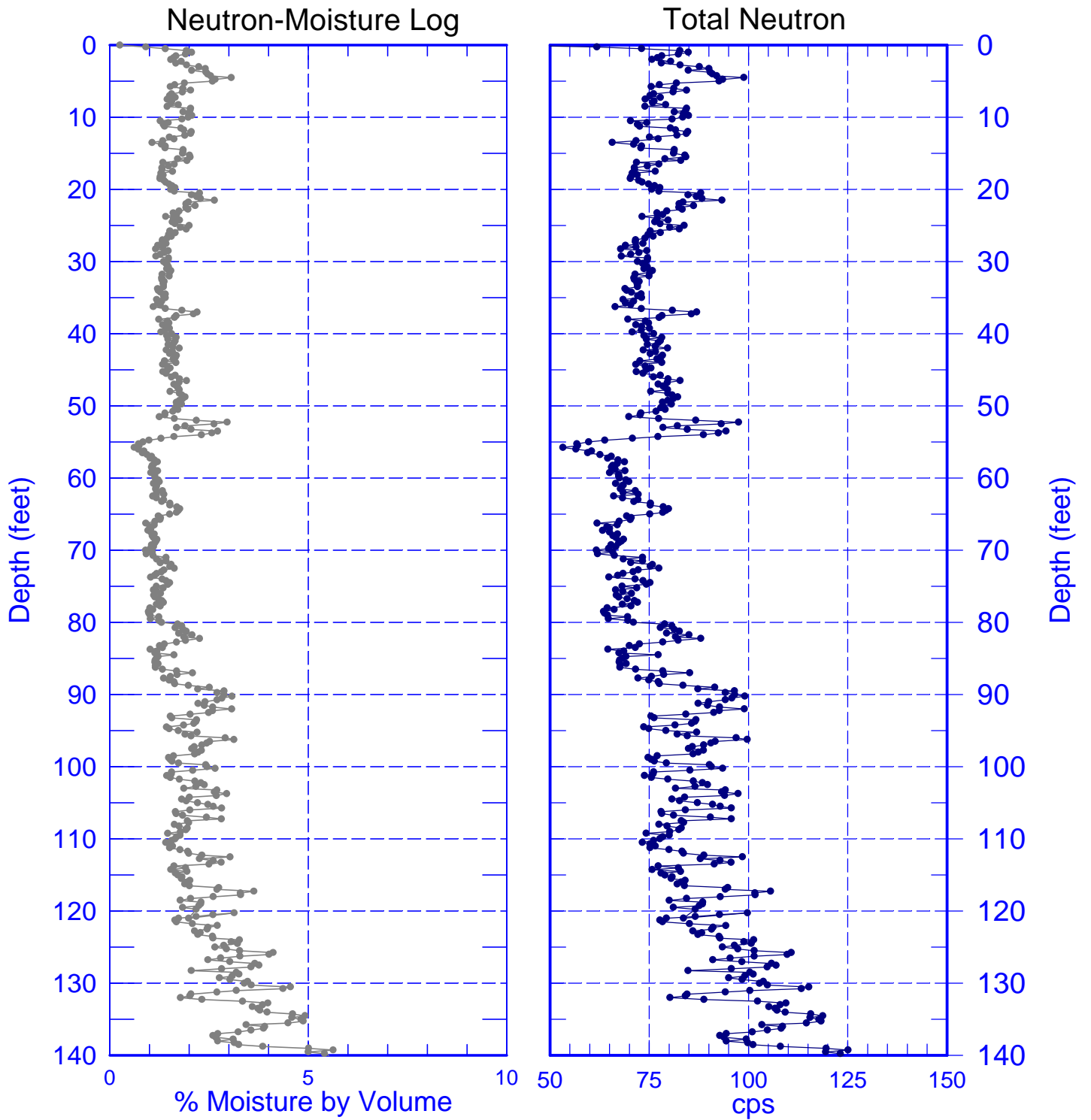
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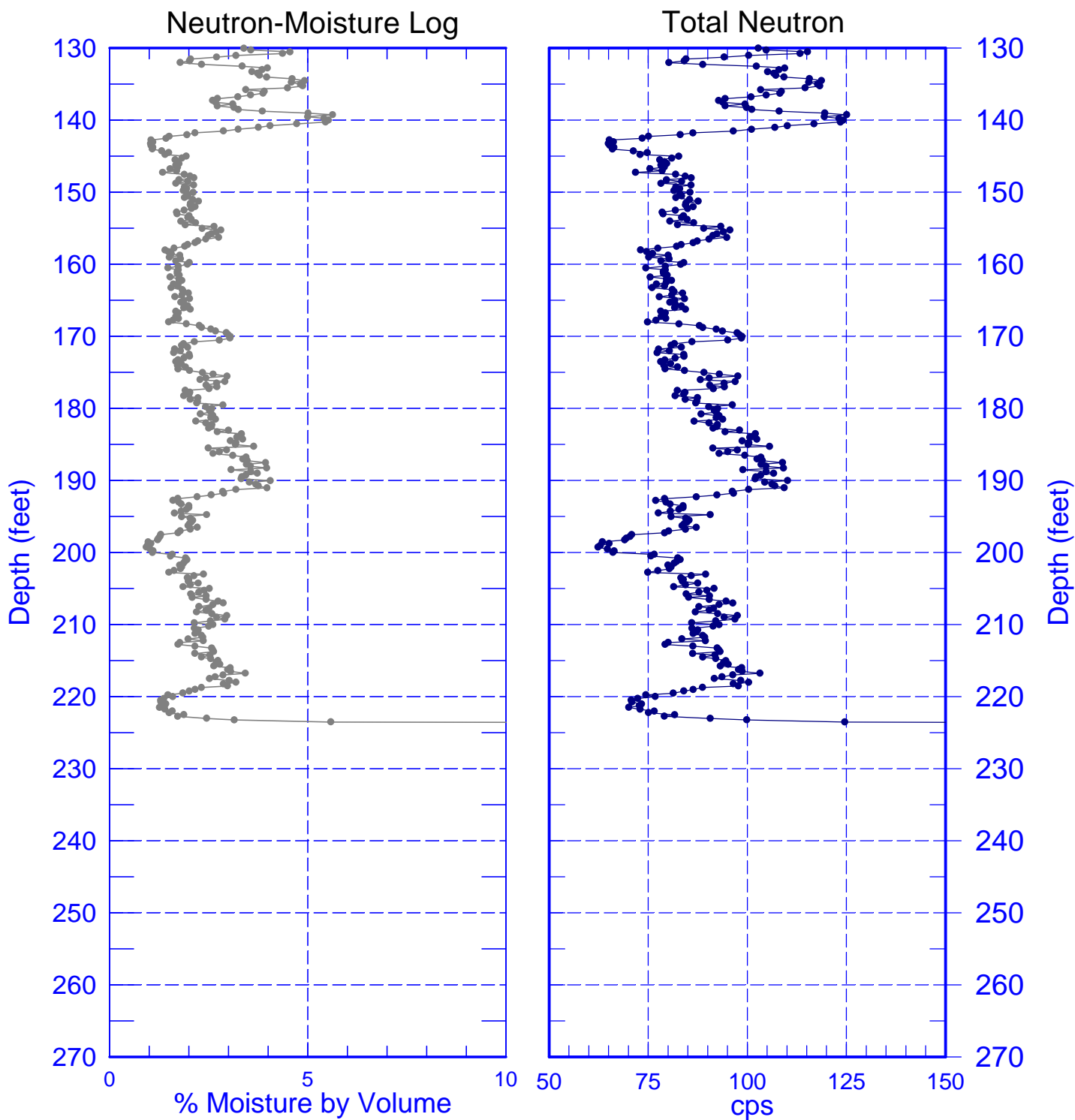
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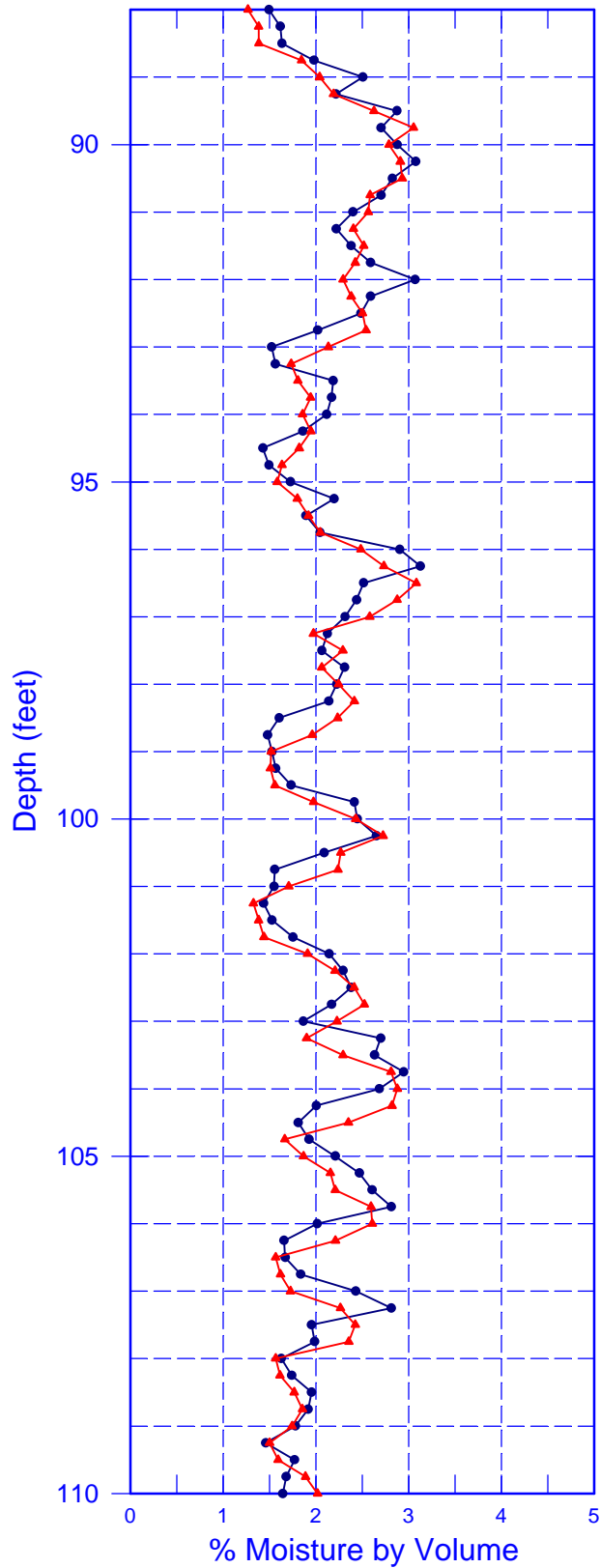
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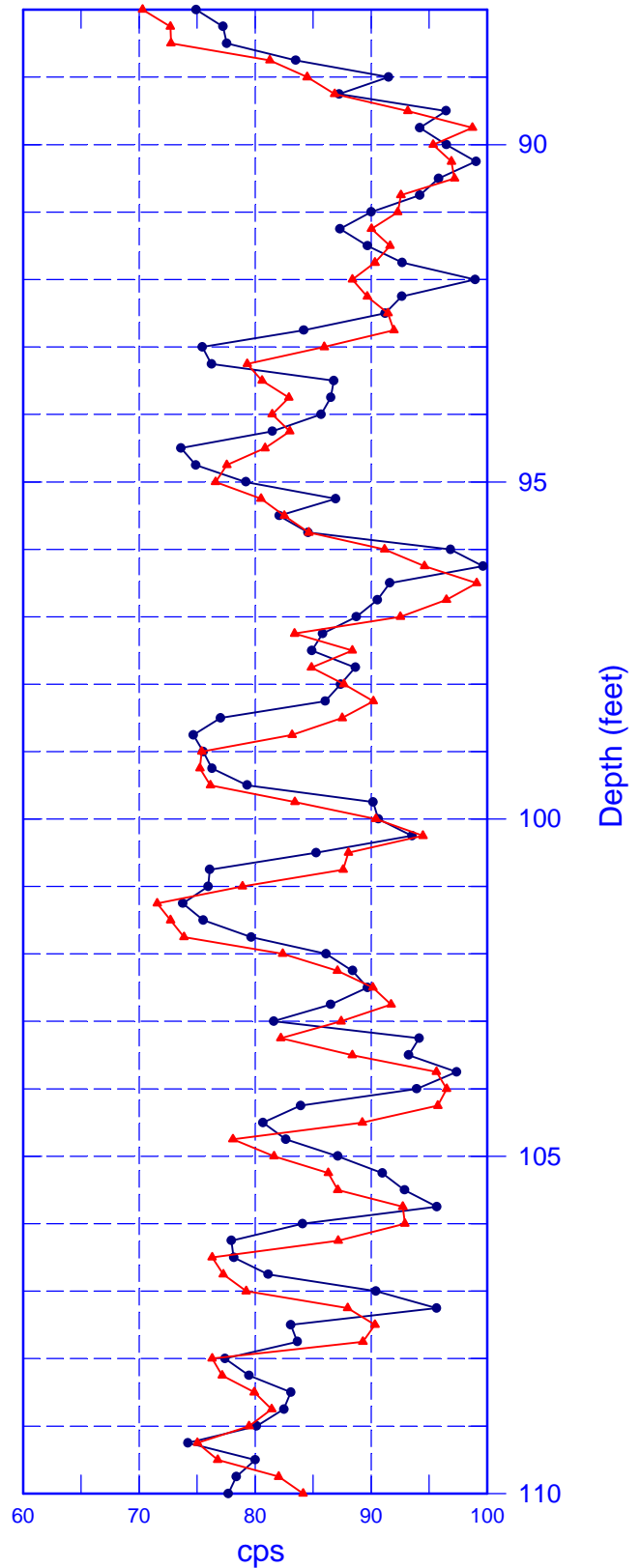
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Rerun of Neutron-Moisture Logs

Neutron-Moisture

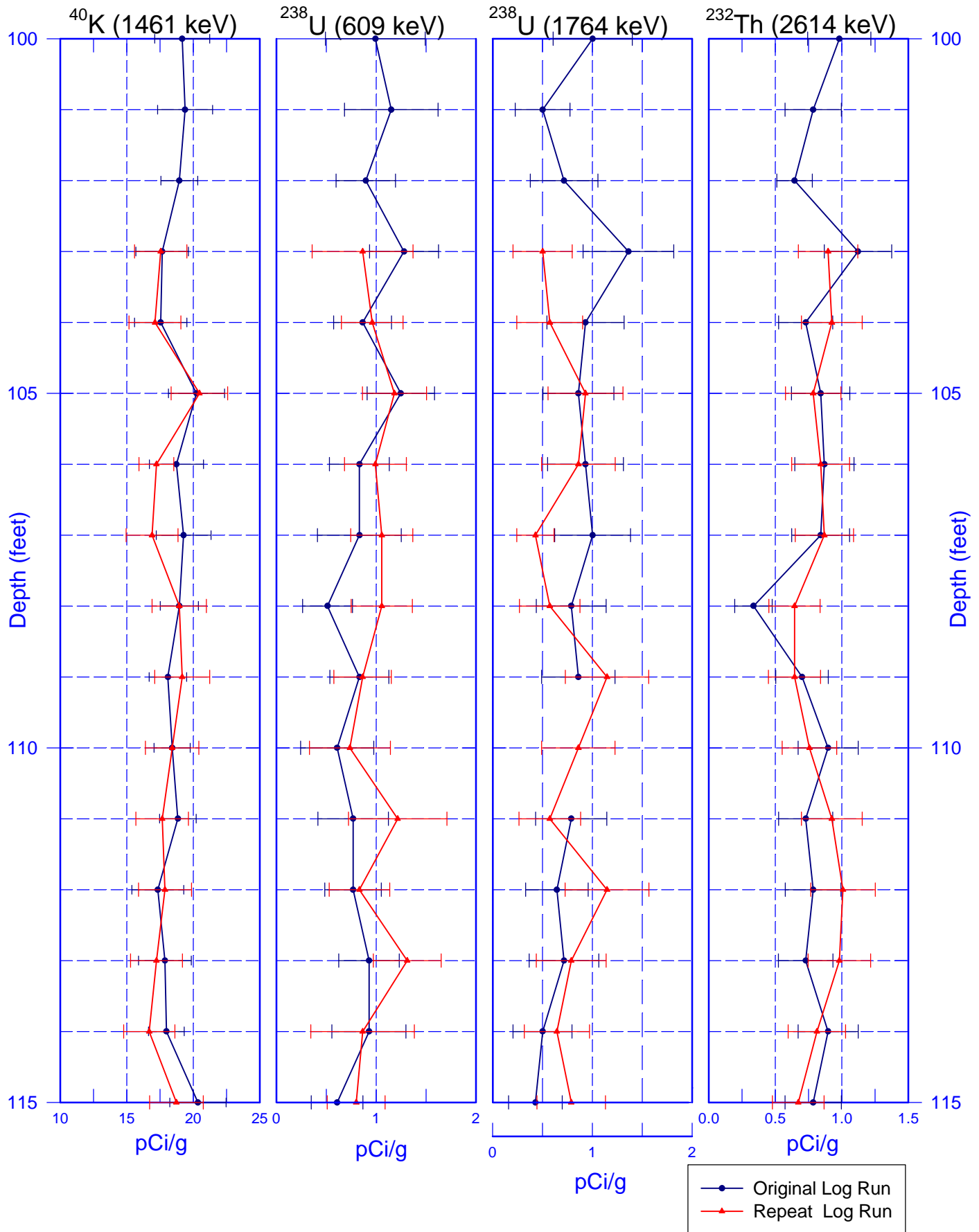


Total Neutron



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First Rerun of Natural Gamma Logs



299-W19-45 (C3394)

Second Rerun of Natural Gamma Logs

